

ABSTRACT

A method of forming copper films at low temperatures is provided. The method comprises two steps of forming a copper oxide layer from a non-fluorine containing copper precursor on a substrate and reducing the copper oxide layer to form a copper layer on the substrate. The formation of copper oxide is carried out by atomic layer deposition using a non-fluorine containing copper precursor and an oxygen containing gas at a low temperature. Copper alkoxides, copper β -diketonates and copper dialkylamides are preferred copper precursors. The reduction of copper oxide layer formed is carried out using a hydrogen containing gas at a low temperature.